Philosophy of Systems and Synthetic Biology

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This entry aims to clarify how systems and synthetic biology contribute to and extend discussions within philosophy of science. Unlike fields such as developmental biology or molecular biology, systems and synthetic biology are not easily demarcated by a focus on a specific subject area or level of organization. Rather, they are characterized by the development and application of mathematical, computational, and synthetic modeling strategies in response to complex problems and challenges within the life sciences. Systems and synthetic biology shed new light on several important discussions in philosophy of biology, but they are also philosophically interesting for their own sake. By pursuing ambitious aims such as the development of multi-scale computational models and synthetic life forms, they uncover new ground for philosophical analysis. Proponents of systems and synthetic biology often stress the necessity of a perspective that goes beyond the scope of molecular biology and genetic engineering, respectively. With the emphasis on systems and interaction networks, the approaches explicitly engage in one of the oldest philosophical discussions on the relationship between parts and wholes, or between reductionism and holism. Such questions are, however, reframed in the new light of strategies for large-scale data production and dynamic modeling inspired by non-biological disciplines such as engineering. Accordingly, systems and synthetic biology raise fundamental questions about how far research can be taken through computational approaches, about the relation between living and artificial systems, and about the implications of interdisciplinary research for science and society.